on the basis of a power-equivalent variable such as cumulative air quantity. It is thus respectfully submitted that those skilled in the art would readily understand how to determine the total energy output of the internal combustion engine within a predetermined time period. Without further discussion thereof, Applicant submits that the step of determining total energy output is sufficiently disclosed in the specification to enable those skilled in the art to carry out the step.

In view of these considerations, it is respectfully submitted that the rejection of claims 9-19 under 35 U.S.C. §112, first paragraph is overcome and should be withdrawn.

The present invention defines a process for detecting a state of a catalyst system installed in an exhaust chamber of an internal combustion engine of a motor vehicle, through which catalyst system exhaust gas from the internal combustion engine flows so that the exhaust gas can be purified. The process includes the steps of detecting at least one operating parameter of the catalyst system over a predetermined time period, determining a total energy output of the internal combustion engine within the predetermined time period, and calculating a characteristic value based on a ratio of the at least one operating parameter to the total energy output. The present invention discloses a unique combination of steps in which the total energy output of the internal combustion engine is used for detecting a state of the catalyst system.

It is respectfully submitted that the claims differ essentially and in an unobvious, highly advantageous manner from the methods disclosed in the references.

Turning now to the references, and particularly to the patent to Mitsutani et al., it can be seen that this patent discloses a device for determining deterioration of a catalytic converter for an engine. Mitsutani et al. disclose the problem that the oxygen storage capability of the catalytic converter is heavily dependent on the temperature of the catalyst and the exhaust gas mass flow. Measuring the oxygen storage capability of the catalyst, Mitsutani et al. compare signals from oxygen sensors LVOS and LVOM which are arranged upstream and downstream of the catalyst (see Figures 2A and 2B and column 8, line 63 through column 9, line 13 of Mitsutani et al.). Through these measurements, a ratio of the sensor signals LVOS/LVOM is created. From this ratio LVOS/LVOM, a determination is made as to whether the catalyst has deteriorated. When the catalyst has not deteriorated, the ratio of LVOS/LVOM is much smaller than 1.0. Due to the temperature dependence of the oxygen storage capability of the catalyst, at higher temperatures

the ratio of LVOS/LVOM is smaller and at lower temperatures is greater. Due to the dependence of the oxygen storage capability of the catalyst on exhaust gas flow, at equal erosion of the catalyst, the value for the ratio of LVOS/LVOM is large with high exhaust gas mass flow and is small with lower exhaust gas flow so that the stored oxygen at one time is given out faster and at the other time is given out slower. Additionally, due to the differing values for the intake airflow rate Q and the temperature of the catalyst, the ratio LVOS/LVOM has a dispersion of +/- 0.3 (see Mitsutani et al. column 13, line 55 through column 13, line 33). Thus, pursuant to Mitsutani et al. it is not sufficient to vary the threshold value for the ratio of LVOS/LVOM in dependence on the temperature of the catalyst and the exhaust gas flow. Mitsutani et al. thus suggest determining the condition of the catalyst based on the ratio LVOS/LVOM only when a combination of the temperature of the catalyst and the fresh air input Q is such that for a normal catalytic converter the ratio is always less than 0.2 (see column 4, lines 34-40 of Mitsutani et al.), and for a defective catalyst it is greater than 0.8 (see column 15, lines 1-5 of Mitsutani et al.). Mitsutani et al. believe that this should safely determine that a functional catalyst would confidently be determined to be functional and a defective catalyst would confidently be determined as defective (see Mitsutani et al. column 15, lines 13-19), independent of the fluctuation of the ratio LVOS/LVOM with changes in the temperature in the exhaust gas mass flow.

In summary, Mitsutani et al. only teach that the ratio LVOS/LVOM should be determined at specific temperatures of the catalyst and air inlet mass flows, whereby the air inlet mass flow Q is only used as an equivalent value for the exhaust gas mass flow (see Mitsutani et al., column 13, lines 53-54 and column 15, lines 65-67).

Mitsutani et al. do not disclose determining the total energy output of the internal combustion engine as in the presently claimed invention recited in claim 9. Furthermore, Mitsutani et al. do not disclose determining the total energy output based on a power equivalent variable such as cumulative air quantity as recited in claims 15 and 16. Thus, Mitsutani et al. do not disclose a ratio of at least one operating parameter of the catalyst system to the total energy output and from this to detect the state of the catalyst system, as in the presently claimed invention.

Once again, Mitsutani et al. disclose neither the determination of the total energy output of the internal combustion engine, nor do they calculate the characteristic value based on the ratio of the at least one operating parameter to the total energy output, as in the presently claimed invention. The only thing Mitsutani et al. disclose is the determination of the value of the LVOS/LVOM. This is only a ratio of the oxygen content upstream of the catalyst relative to the oxygen content downstream of the catalyst.

In view of these considerations, it is respectfully submitted that the rejection of claims 9, 11, 13 and 15-19 under 35 U.S.C. §102(b) over the above-discussed reference is overcome and should be withdrawn.

The patent to Mukaihira et al. discloses a system for diagnosing the deterioration of a catalyst. In Mukaihira et al., the conversion efficiency of the catalyst is calculated from the outputs of oxygen sensors, and the conversion efficiency is corrected using the estimated temperature of the diagnostic device. The temperature of the catalyst is estimated based on the flow rates of the intake air (see column 8, lines 43-51 of Mukaihira et al.). From the value of the flow rate of the intake air, an estimated temperature of the catalyst is read from a table (Temperature Map 800) (see Mukaihira et al. column 8, line 57-67). Mukaihira et al. do not disclose either the determination of a total energy output of the internal combustion engine nor do they disclose the calculation of a characteristic value based on a ratio of at least one operating parameter to the total energy output as in the presently claimed invention. Additionally, Mukaihira et al. do not disclose using a ratio of at least one operating parameter to the total energy output for determining a characteristic value for the purposes of detecting a state of the catalyst system. Mukaihira et al. only disclose estimating the temperature of the catalyst based upon the flow rate of the intake air. There is absolutely no disclosure of a determination of total energy output of an internal combustion engine. The flow rate of intake air is not equivalent to the total energy output.

In view of these considerations, it is respectfully submitted that the rejection of claims 9-17 and 19 under 35 U.S.C. §102(b) over the above-discussed reference is overcome and should be withdrawn.

Reconsideration and allowance of the present application are respectfully requested.

In the event the fee is inadvertently not enclosed or if any additional fee during the prosecution of this application is not paid, the Patent Office is authorized to charge the underpayment to Deposit Account No. 15-0700.

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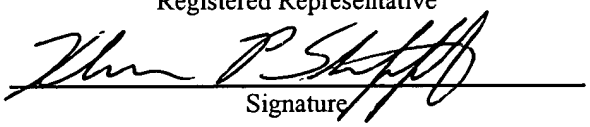

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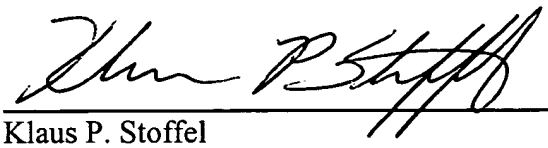
Respectfully submitted,



Klaus P. Stoffel
Registration No.: 31,668
OSTROLENK, FABER, GERB & SOFFEN, LLP
1180 Avenue of the Americas
New York, New York 10036-8403
Telephone: (212) 382-0700

KPS:sks